LATE QUATERNARY MARINE RECORD OF THE CAPE PARRY - CLINTON POINT REGION, DISTRICT OF MACKENZIE

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INTRODUCTION

The Cape Parry - Clinton Point study area (Fig. 1) comprises Parry Peninsula, Darnley Bay and the coastal lowlands north of the Melville Hills. This region was investigated during the summer of 1988 in order to record the marine stratigraphy and the major raised marine geomorphic features. Twenty stratigraphic sections were measured of which seven are summarized in Table 1. These sections represent sedimentary sequences of glaciomarine and marine deposits associated with the retreat of the last ice sheet from this area. A series of perched deltas record the approximate limit of marine submergence as well as successively lower sea levels.

As few geologists have previously worked in this region, our knowledge of the marine history is rather limited. O'Neill (1924) made several general observations regarding Pleistocene deposits along the Arctic coast. Mackay (1952, 1958) and Klassen (1971) mapped the major glacial landforms such as end moraines, eskers and glacial lineations, and discussed the glacial history of the region. More recent preliminary work was carried out by J.-S. Vincent who first recognized evidence for marine submergence south of Darnley Bay and who provided age estimates for deglaciation. The surficial deposits immediately to the east of the study area were mapped by St-Onge et al., (1987) on the basis of morphosedimentary zones, and Kerr (1987) provided an account of the marine stratigraphic sequences.

Geomorphic features of the marine episode

The coastline of the Cape Parry - Clinton Point region is dotted with a series of perched deltas and to a lesser extent, raised beaches. The deltas range in elevation from 6 m a.s.l. south of Cape Parry to 98 m a.s.l. on the Brock River

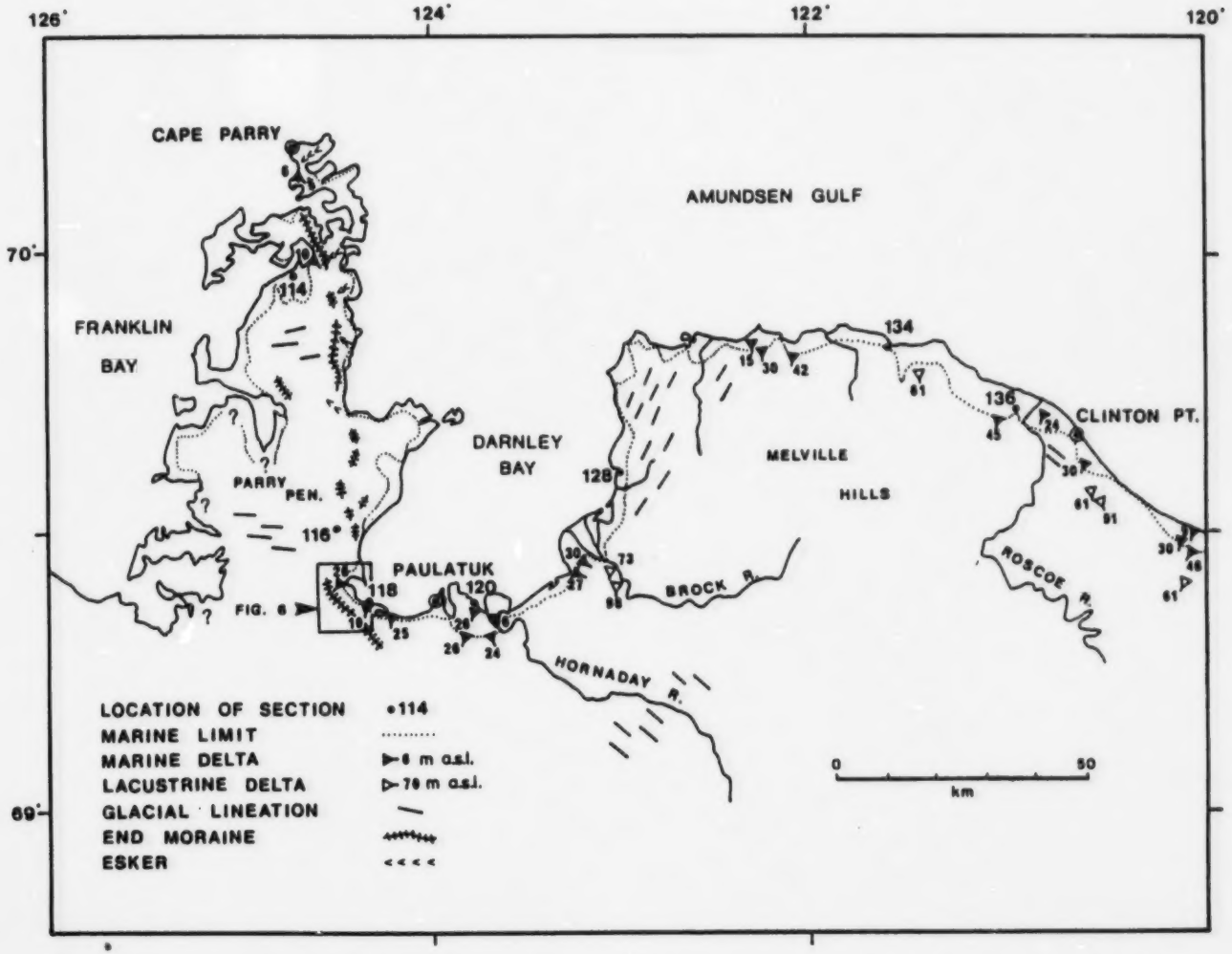

Figure 1. Map of the Cape Parry - Clinton Point region, showing areas submerged by the postglacial sea and related geomorphic features.

46 m a.s.l. east of Clinton Point and decreases to the west, attaining 6 m a.s.l. near Cape Parry (Fig. 1). Debris flows originating from this melting ice margin which terminated in the sea at this time are responsive for the diamicton units of sections 128 and 134. The fine-grained sediments that overlie the diamictons were deposited in the sea following ice retreat from the area.

Melt water flowing from masses of stagnant ice inland around Paulatuk and in parts of the Melville Hills is responsible for outwash deposits (sections 116 and 120) and raised bouldery gravel deltas east of Darnley Bay. Based on this preliminary work, the elevation of these features and the associated marin stratigraphic record (sections 114, 118, 134 and 136) indicate that the marine limit rises towards the southeast margin of the study area, a trend which continues considerably further east along the mainland coast (St-Onge et al., 1987). The few deltas found below the limit of submergence suggest that the bulk of sedimentation took place in the early stages of the transgression, so that considerably less sediment was supplied by a smaller number of rivers during the marine regression. The deltaic sequence of section 118 is an example of such deltas built in the latter stages of regression. The coarsening upward trend observed in section 136 is also characteristic of this typical offlap sequence.

Few radiocarbon dates are available in the study area. In the Paulatuk region, peat overlying deltaic sediments collected by J.-S. Vincent and D.A. St-Onge at 2 m a.s.l. yielded an age of 5100 ± 100 BP (GSC-4410), whereas wood and peat collected by D.A. St-Onge from a sandy channel deposit at 2-3 m a.s.l. gave an age of 9600 ± 100 BP (GSC-4480). The oldest date was derived from shells collected by J.-S. Vincent at 6 m a.s.l. between the Hornaday and Brock Rivers, east of Paulatuk; 11280 ± 100 (TO-217). Thus seas level was between 25 m - 6 m a.s.l. about 11300 years ago and had regressed to below 2 m - 3 m a.s.l. by 9600 years in the Paulatuk area. However, it is possible to further define the sea level history of this particular area, as wood collected by J.-S. Vincent (9400 ± 120 BP, GSC-4143) at 1 m a.s.l. indicates that sea level could not have been much higher than 1 m a.s.l. 9400 years ago. Vincent (1983), working on Banks Island to the north of the study area, concluded that, based on marine shells, the postglacial sea was at approximately 21 m a.s.l. by about 11200 ± 100 BP (GSC-2545). This appears to be compatible with the data presently available from the Paulatuk area. Ongoing dating will help elucidate the temporal framework of the marine record.

south of Paulatuk at 21 m a.s.l., and up to 30 m a.s.l. further west. The author found few beaches on Parry Peninsula, but they become increasingly evident, albeit discontinuous, as one follows the coastline to the east, from Paulatuk and the Brock River delta, to Clinton Point, Although none were observed abcve 30 m a.s.l., well-developed flights of beaches of limited extent may rise from present-day sea level to 15 m - 20 m a.s.l. in many small coastal embayments north of the Melville Hills.

DISCUSSION

The study area was glaciated during the last ice advance during which ice flowed around the higher land of the Melville Hills (Fig. 1), as indicated by the local pattern of glacial lineations (Makay, 1958). This resulted in the Amundsen Gulf lobe flowing towards the west and southwest, and a second lobe south of the Melville Hills advancing towards the northwest. According to Dyke and Prest (1987), the area was ice covered from at least 18 000 to 13 000 BP, and was ice free by 12 000 BP. The Early and Late Wisconsin limits of glaciation are thought to lie 50 km west of Parry Peninsula, where ice impinged on the east coast of Cape Bathurst Peninsula (Dyke and Prest, 1987; Rampton, 1988).

During deglaciation, the northerly trending recessional moraines on Parry Peninsula were formed (Fig. 1) which record the successive frontal positions of the Amundsen Gulf lobe (O'Neill, 1924; Mackay, 1958) as it receded towards the east. Fans and outwash plains were deposited on the west side of the moraines by glacial streams whose courses are sometimes marked by eskers on the east side of the moraines (Fig. 1). In the north part of Parry Peninsula, two deltas were constructed into the sea which then occupied the isostatically depressed coastal regions. The sediments of section 114 were deposited at this time in a shallow, quiet water environment.

Proglacial lakes also developed during the early stages of deglaciation in the coastal zone as a result of meltwater accumulating between the more elevated terrain of the Melvill Hills and lobe of ice occupying Amundsen Gulf which blocked drainage to the sea. Northward flowing streams built deltas into these lakes which were successively lowered or drained as the ice front retreated (Mackay, 1958). Six lacustrine deltas were noted in the study area: Two along the Brock River at 73 m and 93 m a.s.l., one north of the Melville Hills at 61 m a.s.l., and three east of Clinton Point at 61 m and 91 m a.s.l. The extent of these ice-marginal lakes has not yet been determined.

Further shrinking of the Amundsen Gulf lobe resulted in the marine incursion from the west along its southern margin between Paulatuk and Clinton Point, establishing the limit of marine submergence which varies from approximately

towards the northeast to northwest. This site is on the edge of a large discontinuous ice marginal out wash complex which covers large areas of the peninsula. There is, however, no direct evidence linking this site to a marine environment, so it is not yet known whether it was or was not built in contact with the sea.

Section118, west of Paulatuk (Fig. 1), is at 10 m a.s.l., and represents a coarsening upward sequence (Table 1) in which bottomset stratified silty clay grades vertically into cross-bedded foreset sand, followed by topset gravel with cobbles. Palaeocurrent directions indicate a flow towards the northwest. Coal fragments are relatively abundant in the cross-bedded unit.

A more complex sedimentary sequence is found in section 120, east of Paulatuk at the mouth of the Hornaday River (Fig. 1), at an elevation of 26 m a.s.l. Here, as in section 118, a coarsening upward trend can be observed (Table 1). Stratified sand, silt and clay grade up into cross-laminated sand with palaeocurrents towards the northeast, overlain by planar and cross - bedded sand with a similar flow direction. Rare twigs are found in the uppermost sandy unit, as are coal fragments, which may also be found throughout the section. This site may also be part of an ice marginal outwash complex built in contact with the sea, as it forms a mound rising above the surrounding lowlands.

Section 128 on the east side of Darnley Bay (Fig. 1) at 6.5 m a.s.l. is the most westerly occurrence of a fine-grained matrix-supported diamicton which can be seen in sections along the coastline north of the Melville Hills an which continues further east along the mainland coast Kerr, (1987). The stony massive diamicton (Table 1) is overlain by a sandy silty clay unit which contains in situ shells of Hiatella arctica, the foraminifera Elphidium orbiculare, E. bartletti and Pseudopolymorhina novangliae, as well as the ostracode Cytheropteron montrosiense. A comparable stratigraphic sequence occurs in section 134 (Table 1), north of the Melville Hills, at 16.5 m a.s.l. (Fig. 1). The unstratified diamicton is underlain by bedrock and overlain by interlaminated sand, silt and clay. Near the surface, these sediments yielded fossils of Hiatella arctica and Elphidium bartletti.

A coarsening upward trend in section 136 near the Roscoe River (Fig. 1) is the last sequence observed in the marine stratigraphy of the study area (Table 1). Basal silty clay grades vertically into stratified sand and silt which in turn grades into sand and gravel. Fossils of Hiatella arctica and Portlandia arctica were recovered from these units.

As noted earlier, raised beaches may be found within the study area, although they are not as common or as spectacular as in other coastal regions of the Arctic islands or the mainland. O'Neill (1924) recorded beach deposits

and 91 m a.s.l.[1] south of Clinton Point (Fig. 1). They are generally composed of pebbly sands and bouldery gravel. O'Neill (1924) reported the presence of deltas 15 km to 25 km inland on the east side of Darnley Bay, however time did not permit their investigation, nor that of strandlines, during the 1988 field season.

In the central and northern parts of Parry Peninsula, a series of north-south trending moraines can be found; eskers on the east side lead up to the moraines which occasionally are breached. Here, on the side of the moraines, two deltas lie at 6 m and 10 m a.s.l. (Fig. 1), whereas at higher elevations in the central and southern part of the peninsula, fans and out wash deposits are more common.

In the Paulatuk area, seven deltas vary in elevation between 6 m and 26 m a.s.l. Two of these may be associated with local deposits of pitted outwash, whilst some are related to the ancestral Hornaday River (Fig. 1), as well as other fluvial systems which no longer flow in the area. Four additional deltas occur near the Brock River (Fig. 1), two of which are at considerably higher elevations than the previously discussed deltaic sediments. North of the Melville Hills the remaining deltas, are at intervals of up to 25 km, and range from 9 m to 91 m a.s.l. Some of those at higher elevations (61 m and 91 m, Fig. 1) were built in contact with the ice, exhibiting such features as kettle lakes and collapse structures, and lateral gradations into kames.

Stratigraphic record of the marine submergence

Section 114, situated in the north-central area of Parry Peninsula (Fig. 1) at an elevation of 5 m a.s.l. (top of section), consists of stratified sand and silt, capped by active eolian cliff-top dunes (Table 1). These laminated to bedded fine-grained sediments have both sharp and gradational upper and lower boundaries, and are fossiliferous in the lower half of the section; the foraminifera Elphidium clavatum and Pseudopolymorphina novangliae, as well as the marine ostracode Cytheropteron montrosiense are in an excellent state of preservation, show no signs of abrasion due to transport, and many ostracodes were found as paired valves.

Section 116, in the south central region of Parry Peninsula at 30 m a.s.l. (Fig. 1) is composed of a series of interstratified planar and cross-bedded sands (Table 1) which contain high proportions of coal fragments, derived from the local bedrock. Palaeocurrent directions of cross-bedded strata suggest a flow

[1]Elevation measured by helicopter altimeter, probable accuracy ± 6 m (Stan A. Smith, Associated Helicopters, personal comm., 1988).

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Table 1. Stratigraphy of the Cape Parry - Clinton Point region

Thickness	Material
A. Stratigraphy of section 114 on Parry Peninsula, 5 m a.s.l.	
0.5 m	Eolian sand, fine-grained, light brown, finely laminated
1.0 m	Sand, fine-grained, light brown, massive to poorly laminated
1.5 m	Sand, fine-grained, gray-brown, thinly bedded, fossiliferous
2.0 m	Thinly bedded fine sand and silt, gray brown, interbedded with silty clay horizons, fossiliferous
B. Stratigraphy of section 116 on Parry Peninsula, 30.5 m a.s.l.	
0.2 m	Sandy peat
0.75 m	Cryoturbated fine sand and silt, light gray, occasional rounded gravel and cobble clasts, contorted organic pods
0.6 m	Fine sand and silt, light gray, thinly bedded, containing silty clay lenses
3.0 m	Sand, medium to fine-grained, gray, finely laminated
3.0 m	Coarse sand, dark gray, with minor gravel, thin horizons of coal fragments, planar cross-bedded strata dipping 20°-30° towards 030°-350°
1.0 m	Medium-grained gray sand, with thin horizons of coal fragments, planar cross-bedded, dipping 10° towards 345°
1.5 m	Massive coarse sand, dark gray, containing small coal lenses
2.0 m	Medium-grained gray sand, massive to poorly laminated, interbedded with a coarse sand horizon with abundant coal fragments
C. Stratigraphy of section 118 west of Paulatuk, 10 m a.s.l.	
0.4 m	Poorly stratified sandy gravel with small cobbles, cryoturbated

con't . . .

Table 1, con't

Thickness	Material
1.0 m	Medium to coarse sandy gravel, gray brown, unstratified to thinly bedded, with lenses of pebbles and cobbles
	con't . . .
6.0 m	Fine-grained gray sand, beds alternating with fine sandy silt, forming cross-bedded strata dipping 30° towards 335°, rare gravel clasts in lower section and discontinuous layer of coal fragments throughout
2.5 m	Interbedded, dark brown silty clay and medium-grained, brown sand beds with thin horizons of coal fragments

D. Stratigraphy of section 120 east of Paulatuk, 26 m a.s.l.

2.5 m	Inter bedded, medium to coarse-grained, light gray sand and laminated fine, gray sand with coal fragments and rare twigs
1.5 m	Massive to poorly laminated, medium-grained gray sand
1.8 m	Laminated, medium-grained sand, forming cross-stratification dipping 20° towards 065°
2.2 m	Thinly bedded to laminated, medium-grained, palaeocurrents toward 045°-060°
1.0 m	Fine sand and silt, gray brown, massive
1.75 m	Interbedded brown, medium-grained sand and dark silty clay
3.0 m	Fine sand and silt strata interbedded with silt beds
1.5 m	Massive silt and clay with stringers of medium-grained sand
4.0 m	Thinly bedded to laminated fine sand, silty sand an silt layers interbedded with horizons of coal fragments

E. Stratigraphy of section128 on east side of Darnley Bay, 6.5 m a.s.l.

1.3 m	Fine sand, silt and clay, massive, fossiliferous
1.2 m	Silt and clay, massive to poorly stratified, with fossiliferous horizon
0.2 m	Medium to fine grained sand, silt and clay with rare small cobbles, massive
2.8 m	Unstratified diamicton, san-silt matrix, numerous gravel to

con't . . .

Table 1, con't

Thickness	Material
	cobble clasts, angular to rounded
1.0 m	Covered

F. Stratigraphy of section 134 north of Melvill Hills, 16.5 m a.s.l.

3.0 m	Interstratified medium to fine-grained sand, silt and clay, laminated to thinly bedded, fossiliferous near top
1.5 m	Unstratified diamicton, sand-silt matrix, angular to rounded gravel and cobble clasts
3.0 m	Bedrock

G. Stratigraphy of section 136 near Roscoe River, 24 m a.s.l.

3.5 m	Inter bedded medium to fine-grained sand and coarse sandy gravel strata, planar laminated to thinly bedded, fossiliferous in lower half
4.5 m	Fine-grained sand and silt, massive to poorly stratified, fossiliferous
4.0 m	Interstratified sandy silt and silty clay, laminated to thinly bedded
6.0 m	Silt and clay, dark gray, massive